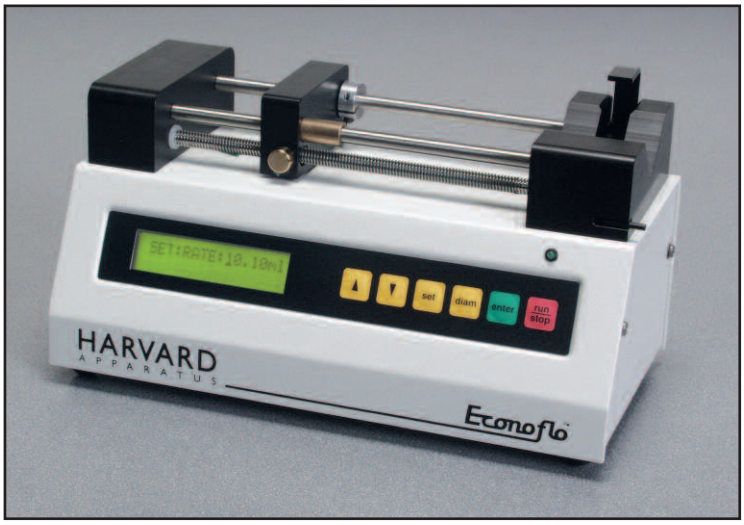
Econoflo
Syringe Pump
User's Manual

Econoflo Syringe Pump MA1 70-2205



HARVARD
APPARATUS

Publication 5410-001-REV-B

WEEE/RoHS Compliance Statement

EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive – Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.

- **Do Not Dispose Product with Municipal Waste**
- **Special Collection/Disposal Required**

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Serial Number
All inquires concerning our product should refer to the serial number of the unit. Serial numbers are located on the rear of the chassis.

Calibration
All syringe pumps are designed and manufactured to meet their performance specifications at all rated voltages and frequencies. A calibration certificate is available upon request. Contact customer service for details and pricing.

Warranty
Harvard Apparatus warranties this instrument for a period of two years from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or material.

This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident.

This warranty extends only to the original customer purchaser.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the two-year warranty period, promptly contact your local distributor or ***Harvard Apparatus, Inc. 84 October Hill Road Holliston, Massachusetts 01746-1388*** using our toll free number 1-800-272-2775 (valid only in the U.S., outside U.S. call 508-893-8999). Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

Repair Facilities and Parts
Harvard Apparatus stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample or drawing. We offer a complete reconditioning service.

CAUTION
This pump is not registered with the FDA and is not for clinical use on human or veterinary patients. It is intended for research use only.

CAUTION

FOR RESEARCH USE ONLY

NOT FOR CLINICAL USE ON PATIENTS

General Safety Summary

Please read the following safety precautions to ensure proper use of your syringe pump. To avoid potential hazards and product damage, use this product only as instructed in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

To Prevent Hazard or Injury:

Use Proper Power Supply

The pump is supplied with an approved power supply and line cord. To maintain the safety integrity of the device, use only one of the following power supplies:

Ault, Inc.

Model:	PW118
Output:	12 Vdc, 1.5 A
Input:	100-250 Vac, 50-60 Hz, .5A

Cui, Inc.

Model:	SA06N12-V
Ouptut:	12 Vdc, 2.0 A
Input:	100-240 Vac, 50-60 Hz, .8A

Globtek, Inc.

Model:	GT-4201D-12
Output:	12 Vdc, 1.66 A
Input:	100-240 Vac, 50-60 Hz, .6A

Use Proper Line Cord

Use only the line cord shipped with the product and make sure line cord is certified for country of use.

Ground the Product

This product is grounded through the return path of the DC power supply. To avoid electric shock, use only approved power supply and line cord with the product.

Make Proper Connections

Make sure all connections are made properly and securely.

Observe all Terminal Ratings

Review the operating manual to learn the ratings on all connections.

General Safety Summary

Avoid Exposed Circuitry
Do not touch any electronic circuitry inside of the product.

Do Not Operate with Suspected Failures
If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

Observe all Warning Labels on Product
Read all labels on product to ensure proper usage.

CAUTION
Refer to Manual

Functional Ground Terminal

Enviromental Conditions

Indoor use only

Temperature 4°C to 40°C (40°F to 104°F)

Humidity 20% to 80% RH

Well Ventilated Room

Altitude up to 2000 m

Mains Voltage Fluctuation not to Exceed +/- 10% of Nominal

Transient Overvoltage Category II

Pump is Rated Pollution Degree 2 in Accordance with IEC 664

Theory of Operation:

The Econoflo Pump is designed as a low cost, single syringe infusion pump capable of low to moderate back pressures.

The pump can hold one syringe of any make from 0.5 µl to 60ml. The diameter of the syringe(s) is entered via the keypad and the internal microprocessor drives a precision stepper motor to produce accurate fluid flow.

Non-volatile memory stores the last syringe diameter and flow rate along with other configuration data.

The "Power Failure Mode" can be set to either turn the pump off in the event of power failure or to resume pumping when power resumes.

Features:

LCD Display and Easy-To-Use Interface

A new, two-line 16 character liquid crystal display with backlite along with six membrane keys make this a most attractive but powerful, easy-to-use syringe pump. Only two entries required to start pumping; syringe Inside Diameter (mm) and pumping flow rates. The Flow rate can be changed while the Pump is running.

Two Modes of Operation, Constant Flow Rate and Volume Dispense

The Econoflo Pump will operate continuously in RATE mode or accurately dispense a specific amount of fluid in VOLUME mode.

Smooth Flow

New micro-stepping pump profiles deliver very smooth and consistent flow.

Nonvolatile Memory

The pump remembers its last syringe size, flow rate used and configuration settings.

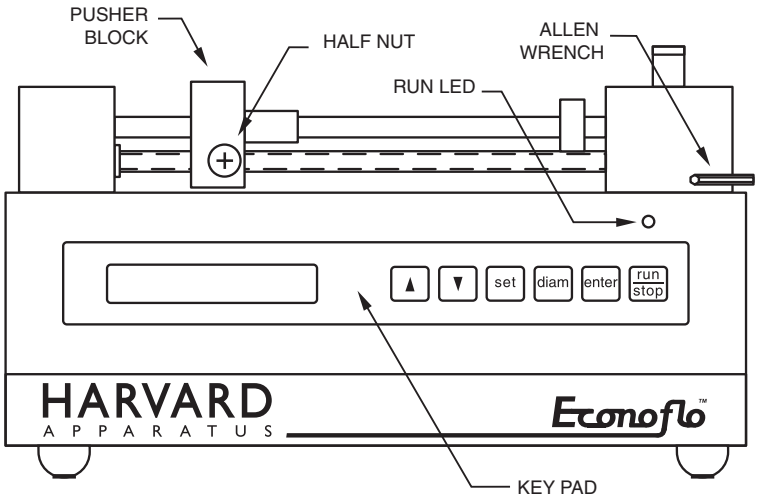
Power Fail Mode

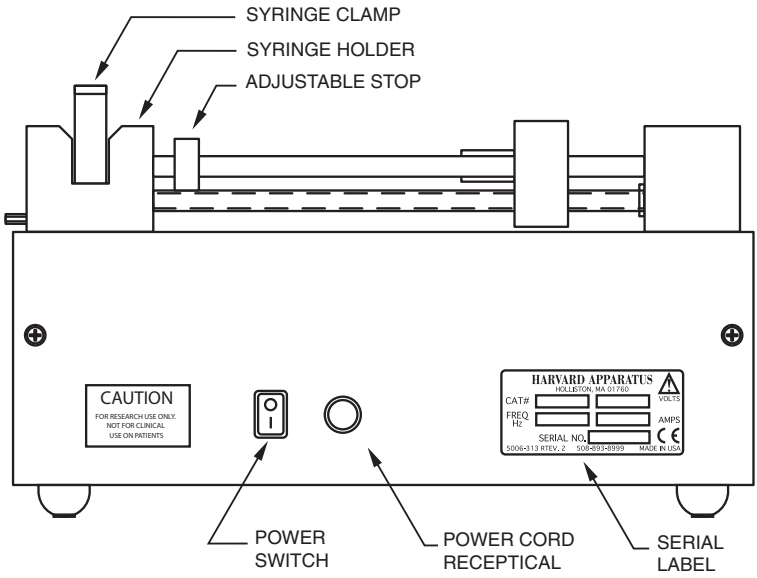
In a power failure the pump can either RESUME or STOP pumping when power is returned.

CE Mark Approved

The new Econoflo Pump meets all relevant European EMC and Safety requirements for laboratory equipment.

Econoflo Front and Rear Views





Initial Set-up

1. Read the manual to become familiar with all features and functions of the Econoflo Pump.
2. Connect the external DC power supply and line cord to the pump and mains supply.
3. Turn on main power switch located on the rear panel. The display will now illuminate indicating that the power connections are correct. The display will indicate POWER FAIL. (this is normal as the pump indicates on the display if power was disrupted since last use.)

Location Requirements for the Syringe Pump

- A sturdy, level, clean and dry surface
- Minimum of one inch (2cm) clearance around the pump
- Appropriate environmental conditions
- A well ventilated room

Loading the Syringe

1. Release the syringe pusher by pressing the bronze button on the side of the pusher.
2. While holding the bronze button 'in', slide the pusher to the left.
3. Raise the spring loaded syringe retainer and swing it out of the way.
4. Lay the loaded syringe in the 'V' shaped holder.
5. Swing the retainer so it holds the syringe in place.
6. Move the pusher so it makes contact with the syringe plunger.

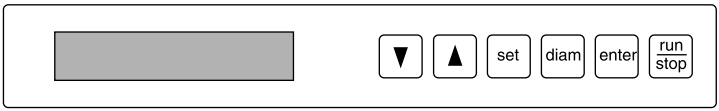
Getting started

1. Turn Pump 'ON'

Turn on power using the switch on rear of the pump, the display will light, and indicate POWER FAIL. (this is normal as the pump indicates on the display if power was disrupted since last use.)

2. Function Keys and Run Indicator

Refer to the colored keypad at the front of the pump to identify the following functions starting from the right.



RUN/STOP – This turns the pump motor on and off.

ENTER – This key enters the data that is on the display into the memory of the pump. Also used to query the flow rate.

DIAM – Used to enter or query the syringe diameter.

SET – This key is used to select which digit of the display is to be changed, to move the decimal point and to move between modes. Each time the set key is pressed the underline cursor below the digit or character on the display moves one step to the right. It is used in conjunction with the ascending and descending keys. When it the display shows the desired the correct value the set key will advance right to the next digit.

△▽ – The ascending and descending keys are used to change the numbers on the display. △ Up key makes numbers increase, ▽ Down Key makes numbers decrease. When the underline cursor is placed below the decimal point, the △▽ keys shift the decimal one place up or down.

Run Indicator – When the pump is running, the highly visible, green LED above the RUN/STOP key will illuminate.

3. Enter Syringe Size

Enter the inside diameter (ID) of the syringe you wish to use. Units are in millimeters (mm).

If you do not know your syringe diameter, refer to appendix B for nominal inside diameters of most popular syringes. For the greatest accuracy or if your syringe is not listed in appendix B, measure the inside diameter with a vernier caliper or other precision measuring tool. Record this value for future use.

Press SET followed by the DIAM key. The previously used diameter will appear on the display. The underline cursor will appear under the left-most digit or decimal point. The △ and ▽ keys are used to scroll to the desired number and the SET key moves the underline cursor one place to the right. Once the desired diameter is displayed, press the ENTER key to place this value into memory.

4. Enter Flow Rate Range

Choose your flow rate units; either microliters or milliliters, per minute or per hour.

From the initial RATE VOL CONFIG menu, using the △ or ▽ key, move the underline cursor under the CONFIG mode menu prompt. Press the SET key to enter the CONFIG mode. Press the SET key again to move the underline cursor to the flow rate choices. Choose your flow rate units while in the SET:UNITS mode by pressing the △ or ▽ keys to scroll the four flow rate choices; ml/min, µl/min, ml/hr, µl/hr. Once the desired flow rate units are displayed, press the ENTER key to return to the main SET:CONFIG mode. Press SET or ENTER again to put your desired flow rate units into memory and return to the RATE VOL CONFIG menu.

5. Enter Flow Rate

From the initial RATE VOL CONFIG menu, press the SET key to enter the SET:RATE mode. Each time you change the syringe diameter, the previously used flow rate is erased. If the syringe diameter is unchanged, the previously used flow rate will appear on the display. The underline cursor will appear under the left-most digit or decimal point. The △ and ▽ keys are used to scroll to the desired number and the SET key moves the underline cursor one place to the right. Once the desired rate is displayed, press the ENTER key to place this value into memory.

6. Press RUN

Press the RUN/STOP key to start pump and begin pumping. The Run Indicator (Green LED above the RUN/STOP key) will light when the pump is on and pumping.

7. Check Syringe Often

The Econoflo Pump will not shut itself off when the syringe is empty or is otherwise overloaded. Although this presents no hazard to the user or the pump, it is prudent to check the syringe from time to time.

1. *Volume Mode*

The Econoflo Pump can be set to dispense a precise volume and then stop. To activate the volume dispense mode a target volume must be set.

To set a target volume, at the RATE VOL CONFIG display, move the underline cursor, using the △ or ▽ key, to VOL. Press the SET key to enter the VOL set mode. Use the △ or ▽ key and the SET key to display a target volume from 00.01 to 99.99. Volume units are either ml (milliliters) or µl (microliters). Target volume units are established in the CONFIG SET:UNITS mode; example: if your pumping units are ml/ min or ml/ hr, then the volume dispense units will be ml's. Press the ENTER key to select the desired target volume. Exit the VOL mode by pressing the ENTER key.

Once you press the RUN key, the pump will run until the target volume is delivered. The display will show the actual volume dispensed along with the target volume. Press the RUN key each time you want to repeat the volume dispense. If you press the STOP key during a volume dispense, you can restart the pump at the place you stopped by pressing the RUN key again.

To exit the volume dispense mode, set the target volume to 00.00 or turn off and on the pump via the main power switch. NOTE: In the event of a power failure, the actual dispensed volume and the target volume are not retained in memory. This means that while in volume dispense mode, if a power failure occurred, the pump would not resume volume dispense pumping even if the POWER ON mode was set to run.

2. *Power Failure*

In the event of a momentary or prolonged power failure, the Econoflo Pump can be set to either;

a) Resume pumping when power is returned, with "POWER FAIL" on the display.

b) Not start pumping when power is returned, with "POWER FAIL" on the display.

To set the power fail mode, at the RATE VOL CONFIG display, move the underline cursor, using the △ or ▽ key, to CONFIG. Press the SET key to enter the CONFIG mode options. Use the △ or ▽ key to scroll the CONFIG options until you reach the SET:POWER ON: display. Press the SET key again moving the underline cursor to the right. Use the △ or ▽ key to scroll the POWER:ON choices; 'stop' or 'run'. Press the ENTER key to select either mode. Exit the CONFIG mode by pressing the ENTER key again and save the POWER:ON setting in memory.

3. *Changing Rates*

If the pump is running at an existing rate it will continue to do so until a new rate is entered. Except for volume mode, the flow rate can be changed while the pump is running. As soon as the ENTER key is pressed the pump will change to the new flow rate. To change rates from the keypad, while in volume mode, the pump must be stopped first.

4. *Maintenance*

Keep the pump clean and dry. Avoid liquid spills that may find their way into the electronics.

A small container of grease is provided for periodic lubrication of the lead screw and guide rods. It is important to keep these guide rods clean and lubricated.

To clean the exterior surfaces, use a lint-free cloth to remove loose dust. Use care to avoid scratching the display window. For more efficient cleaning, use a soft cloth dampened with water or an aqueous solution of 75% isopropyl alcohol.

If the pump does not work properly, contact Harvard Apparatus for appropriate instructions.

5. *Protecting Small, Fragile Syringes*

The Econoflo Pump will hold microliter size syringes down to 0.5µl size. These small syringes have fine wire plungers that may be damaged if allowed to bottom out. The pump is equipped with an adjustable stop collar on one of the guide rods. Use the provided hex wrench to position and lock the stop collar to prevent damage to small syringes.

Appendix A

Econoflo Pump Specifications

Type	Microprocessor single syringe, infusion only
Syringe/Size for Econoflo Pump with Holder For:	Plastic or glass
1 Syringe	From .5 µl to 50/60 ml
Flow Rate Range:	
Minimum / Maximum	0.0028 µl/hr with 0.5 µl syringe / 53.11 ml/min with 50/60 ml syringe
Flow Rate Accuracy	± .75%
Calibration	Automatic, enter syringe size up to 35 mm Inside Diameter
Display	2 line, 16 character liquid crystal display with backlite and green run led
Nonvolatile Memory	Stores diameter, rate and configuration settings
Maximum Force	13 kg (29 lb.)
Maximum Pressure	15 p.s.i. with 50/60 cc syringe; 175 p.s.i. with 1 ml syringe
Drive Motor	1.8° step angle motor
Step Rate:	
Minimum / Maximum	1 pulse in 27.6 sec / 200 steps/sec
Pusher Advance/Step	1.6 µm pusher advance per motor step
Pusher Travel Rate:	
Minimum / Maximum	1.4 µm/min / 30 mm/min
Dynamic Range	1 to 16,384
Leakage to Ground	Typically < 150 µA
Ground Resistance	Typically < 0.05 ohms
Input Power Requirement	100/250 Vac, 50/60 Hz (see page 3)
Size, H x W x D	11.4 x 22.9 x 11.4 cm (4-1/2 x 9 x 4-1/2 in)
Weight	2.1 kg (4.6 lb)

Appendix B: Syringe Inside Diameter

Terumo

Size	Diameter
3 cc	8.95 mm
5	13.00
10	15.80
20	20.15
30	23.10
60	29.10

Sherwood–Monoject Plastic

Size	Diameter
1 cc	4.65 mm
3	8.94
6	12.70
12	15.90
20	20.40
35	23.80
60	26.60

Popper & Sons, Inc. "Perfektum" Glass

Size	Diameter
0.25 cc	3.45 mm
0.5	3.45
1	4.50
2	8.92
3	8.99
5	11.70
10	14.70
20	19.58
30	22.70
50	29.00

Stainless Steel

Size	Diameter
8 cc	9.525 mm
20 cc	19.130
50 cc	28.600

Becton Dickinson Plastic "Plasticpak"

Size	Diameter
1 cc	4.78 mm
3	8.66
5	12.06
10	14.50
20	19.13
30	21.70
50/60	26.70

Air–Tite "All Plastic"

Size	Diameter
2.5 cc	9.60 mm
5.0	12.45
10	15.90
20	20.05
30	22.50
50	29.00

Unimetrics Series 4000 & 5000

Size	Diameter
10 µl	0.460 mm
25	0.729
50	1.031
100	1.460
250	2.300
500	3.260
1000	4.610

SGE Scientific Glass Engineering

Size	Diameter
25 µl	0.73 mm
50	1.03
100	1.46
250	2.30
500	3.26
1.0 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57

Hamilton–Microliter Series Gastight

Size	Diameter
.5 µl	0.103 mm
1	0.1457
2	0.206
5	0.3257
10	0.460
25	0.729
50	1.031
100	1.46
250	2.3
500	3.26
1.0 ml	4.61 mm
2.5	7.28
5	10.3
10	14.57
25	23.0
50	32.6

Appendix C: Flow Rates

nominal syringe size	nominal diameter (mm)	µl/hr		µl/min		ml/hr		ml/min	
		min	max	min	max	min	max	min	max
Min	**0.10**	0.0028	44.70	0.0002	0.7450	0.0002	0.0446	0.0002	0.0006
1 µl	**0.15**	0.0062	100.58	0.0002	1.6766	0.0002	0.1004	0.0002	0.0016
2 µl	**0.21**	0.0122	197.16	0.0004	3.2860	0.0002	0.1970	0.0002	0.0032
5 µl	**0.33**	0.0298	486.8	0.0006	8.114	0.0002	0.4868	0.0002	0.0080
10 µl	**0.46**	0.0578	946.0	0.0010	15.766	0.0002	0.9460	0.0002	0.0156
25 µl	**0.73**	0.1456	2,382	0.0026	39.70	0.0002	2.382	0.0002	0.0396
50 µl	**1.03**	0.2896	4,742	0.0050	79.04	0.0004	4.742	0.0002	0.0790
100 µl	**1.46**	0.5818	9,530	0.0098	158.82	0.0006	9.530	0.0002	0.1588
250 µl	**2.30**	1.4436	19,998	0.0242	394.0	0.0016	23.64	0.0002	0.3940
1,000 µl	**3.26**	2.902	19,998	0.0484	791.4	0.0030	47.50	0.0002	0.7918
1 ml	**4.61**	5.800	19,998	0.0968	1583.6	0.0058	95.00	0.0002	1.5836
2.5 ml	**7.28**	14.464	19,998	0.2412	3,948	0.0146	236.8	0.0004	3.948
3 ml	**8.66**	20.48	19,998	0.3412	5,588	0.0206	335.2	0.0004	5.588
5 ml	**10.30**	29.00	19,998	0.4826	7,904	0.029	474.2	0.0006	7.904
10 ml	**14.57**	57.94	19,998	0.9656	15,818	0.0580	949.0	0.0010	15.818
20 ml	**20.05**	109.72	19,998	1.8284	19,998	0.1098	1797.2	0.0020	29.94
30 ml	**23.10**	145.62	19,998	2.428	19,998	0.1458	2,384	0.0026	39.76
50 ml	**53.40**	194.54	19,998	3.244	19,998	0.1946	3,152	0.0034	53.12
Max	**35.00**	**334.4**	**19,998**	**5.572**	**19,998**	**0.3344**	**5,476**	**0.0056**	**91.28**

Declaration of Conformity

Application of Council Directive(s):	*73/23/EEC, 89/336/EEC*
Standard(s) to which conformity is declared:	*EN61010-1 (1993) + A2 (1995), EN 61326: 1997 + A1: 1998 Class A Emissions, Class B Immunity*
Manufacturer's Name:	*Harvard Apparatus, Inc.*
Manufacturer's Address:	*84 October Hill Road Holliston, Massachusetts 01746 U.S.A.*
Type of Equipment:	*Syringe Pump*
Model No.:	*70-2205 (Econoflo)*

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place:	*United States of America*
Date:	*September 06, 2002*

CE

HARVARD APPARATUS

Beth Bauman
(Signature)

Beth Bauman
(Full Name)

VP Engineering / Operations
(Position)